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What is claimed is:

1. A method of programming the differentiation of stem cells comprising:
  - (a) contacting stem cells with precursor cells to form a mixture, whereby the stem cells become primed; and
  - (b) allowing the primed stem cells to differentiate.
2. The method of claim 1 wherein the primed stem cells are introduced into an animal for *in vivo* differentiation.
3. The method of claim 1 wherein the primed stem cells are allowed to differentiate *in vitro*.
4. The method of claim 1 wherein the precursor cell is a limb bud cell.
5. The method of claim 4 wherein the differentiated cell is a chondrocyte.
6. A differentiated cell produced by the method of claim 1.
7. The method of claim 1 wherein the mixture further includes a selection compound.
8. A method to identify signals responsible for cell lineage establishment comprising:
  - (a) defining the prerequisite conditions to the differentiation of stem cells into their preferred lineage; and
  - (b) determining which prerequisite conditions are signals responsible for cell lineage establishment.
9. A method for identifying effective therapeutic agents comprising:

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(a) contacting a first differentiated human stem cell with a test agent;

(b) comparing the results obtained by the test agent with the results of a control agent contacted to a  
5 second differentiated human stem cell from the same cell line.